

# THE TRANS - AUSTRALIAN RAILWAY

## NOMINATION FOR AWARD AS A NATIONAL ENGINEERING LANDMARK

WESTERN AUSTRALIA AND SOUTH AUSTRALIA DIVISIONS  
THE INSTITUTION OF ENGINEERS, AUSTRALIA

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### **CONTENTS**

	<b>Page</b>
1. Statement of Significance	1
2. Commemorative Plaque Nomination	2
3. Assessment of Engineering Heritage Significance	3
4. Federation and an East – West Transcontinental Railway	7
5. Colonial East – West Communications	8
6. Towards a Decision to Build the Railway	10
7. Building the Railway	12
8. Planners and Builders	16
9. References	19

Prepared by the Western Australia and South Australia Divisions  
The Institution of Engineers, Australia

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## **NOMINATION FOR NATIONAL ENGINEERING LANDMARK AWARD**

### **1. STATEMENT OF SIGNIFICANCE**

When the Trans-Australian Railway joined eastern and western Australia in 1917 it provided a physical link which was to be of major commercial and strategic importance and which improved immeasurably the convenience and comfort of interstate travellers. The railway was also a symbol to all Australians of the bonds which had bound the colonies together in Federation.

The Trans-Australian Railway was the first major public work to be undertaken by the Commonwealth Government and at that time it was the largest construction project ever undertaken in Australia. It was built through some of the most inhospitable country to have been traversed by railway in Australia to that date, most of which country was largely uninhabited by Europeans and lacked adequate water supplies. It is still the longest railway ever built at any one time in Australia (1682 km).

The railway's construction operations were unique because, due to the lack of developed infrastructure along the route, the constructing authority had to arrange the complete supply logistics for up to 3000 men working on the railway, in addition to the supply of all the engineering plant and materials and the care of hundreds of horses and camels.

The Trans-Australian Railway is one of the world's most famous railways. It stands head and shoulders above other railways in Australia for its unique character, the type of country it traverses, the environment in which it operates, its length and some of its unique features such as the longest straight length of track in the world.

## **2. COMMEMORATIVE PLAQUE NOMINATION**

### **NAME OF WORK**

The Trans- Australian Railway.

### **PERIOD OF CONSTRUCTION**

1912 to 1917

### **PERIOD OF OPERATION**

From the opening date (17 October 1917) to the present day.

### **LOCATION**

The line extends from Port Augusta Railway station in the east to Kalgoorlie station in the west. Refer to maps in Attachment A.

### **OWNER**

Australian Rail Track Corporation (ARTC)

### **AGREEMENT TO NOMINATION**

Refer to Attachment B.

### **ACCESS TO SITE**

The eastern and western ends of the railway are accessible from the stations and streets of Port Augusta and Kalgoorlie. Except for infrequent access to the railway, where roads or tracks cross the line, most of the railway can only be accessed by rail.

### **FUTURE CARE AND MAINTENANCE**

Australian Rail Track Corporation (ARTC)

### **NAME OF SPONSOR**

### **3. ASSESSMENT OF ENGINEERING HERITAGE SIGNIFICANCE**

#### **3.1 Technological/Scientific Value**

When it was built the Trans-Australian Railway was the largest construction project ever undertaken in Australia. It was built through one of the harshest environments in which railway construction had taken place to that date in Australia . Due to the lack of developed infrastructure along the route the construction authority had to arrange the complete supply logistics for its workforce of around 3000 men together with construction equipment and materials at workplaces which became increasingly distant from the supply bases. The railway introduced a number of technical innovations to Australia including the use of mechanical track-laying machinery, radio communication to coordinate construction and oil fuelled prime movers.

#### **3.2 Historical Value**

The railway was the first major public work to be undertaken by the Commonwealth Government and to many Australians it represented the positive fruits of Federation.

The building of the railway was one of Australia's most politically sensitive construction projects. During its progress the relations between the Federal Government, the responsible ministers and the Government's statutory authority were painfully worked out for the benefit of subsequent generations.

The subsequent importance of the railway to the nation has been demonstrated on many occasions. During the Second World War, for example, it was of great strategic value for the transport of troops and munitions. Today it carries the majority of goods traded between Western Australia and the eastern states.

#### **3.3 Social Significance**

The Trans-Australian Railway was considered by many Australians to symbolise the unification of the continent under Federation, a sentiment best expressed by Sir John Forrest at the opening of the railway: "Western Australia, comprising one third of the continent, hitherto isolated and practically unknown, is from today in reality a part of the Australian Federation. From today, East and West are indissolubly joined together by bonds of steel, and the result must be increased prosperity and happiness for the Australian people".

The Commonwealth Railways' facilities and the employment they offered made significant changes to Port Augusta, and Commonwealth Railways gave the little communities which it created along the line their special character. The building of the railway also had important effects on a number of towns and cities which were nowhere near the railway. The main reason for BHP commencing steelmaking at Newcastle was to manufacture rails for the Trans-Australian Railway, a decision which had a major impact on Australia's industrial development. In the forests of south-western Western Australia the State Government commenced a timber milling industry in virgin karri forest to provide sleepers for the railway. In Perth, a number of interstate trading companies changed their mode of transport from sea to rail, opening new warehousing near the marshalling yards in central Perth.

At a time of high unemployment among itinerant rural workers, due to the 1914-16 drought over most of southern Australia, construction of the railway provided jobs for up to 3000 men at the peak of construction.

### **3.4 Landscape or Environmental Value**

The Trans-Australian Railway is one of the world's most famous railways. One of its greatest attractions is that it allows travelers to have an extensive experience of one of Australia's unique landscapes in a manner which can be replicated in few other places.

### **3.5 Rarity**

The Trans-Australian Railway is the longest railway ever built at any one time in Australia (1682 km). It includes the longest straight stretch of railway in the world, 478 km 193 m.

Unlike previous Australian railways, which had been built by governments to satisfy internal transport demands, the Trans-Australian Railway was built for national political and strategic reasons. It was one of the few railways of equivalent size in the world to have been built with virtually no provision for the collection of traffic along its route.

Its construction was unique at the time because the constructing authority was required to arrange the complete supply logistics for its workforce of up to 3000 men, for the engineering plant and materials, and for hundreds of horses and camels.

When it commenced operation, no other railway in the world was so completely self-contained. Commonwealth Railways ran its own farms and provision stores, including the 'Tea and Sugar' train which provisioned the Railways' small communities on the line. At these, social infrastructure provided included electricity, water, sanitation, housing, schools, sports and cultural centers, and medical services. This together with the settlements' limited occupational range gave these communities a unique character.

During the 40 years in which the railway was worked by steam, its operations were dominated by the need to supply adequate water of the right quality and coal for loco refueling at remote locations, to an extent experienced by few other railways. One fifth of the total tonne kilometers operated was used for the supply of water and coal. After 1933, when locomotive changes were reduced to one change only for trains running between Port Augusta and Kalgoorlie, the run from Cook to Kalgoorlie of 867 kilometres (539 miles) was claimed to be the longest one in the world undertaken by coal burning steam locomotives.

### **3.6 Integrity and Authenticity**

Although the railway has been greatly improved since construction, with heavier rail, concrete sleepers, and more comprehensive stone ballasting, the route and curve/gradient combination of the railway is essentially the same as originally designed and constructed.

Much of the country through which the railway passes has changed little since the railway was constructed, which assists in appreciating the efforts of its builders.

### **3.7 Contribution to Engineering Practice**

A number of innovative practices were introduced by the railway. It was the first in Australia to use mechanical track laying equipment, and with it, tracklaying records were established which stood for nearly fifty years. Radio communication was used in 1915, for the first time in Australian railway construction, in order to communicate between the two approaching rail heads. The Trans-Australian passenger cars also contained a number of

innovations, including electric fans and reading lamps, toilets flushed by compressed air, hot showers, and, of course, a piano.

The most significant advance in practice was in the field of logistics, and in particular, the maintenance of large mobile construction camps. All the amenities of a small town, such as retail stores, boarding houses, hospitals, post offices and savings banks, were included in the camp, which was moved forward on rails as construction progressed. The constructing authority's railwaymen, who came from a variety of Australian, British and colonial railways, established a tradition of innovation, adaptation and initiative in building and maintaining a railway under conditions which seldom occur in the same proportions elsewhere; a tradition which was continued by their successors.

### **3.8 Eminent Persons Associated with Planning and Building the Railway**

**Sir John Forrest**, Premier of Western Australia and member of a number of Commonwealth Governments, for 25 years was the principal political advocate for the construction of the railway.

**Henry Deane**, Railway Engineer-in-Chief for the Department of Home Affairs, was the engineer largely responsible for the planning and initial organisation of the railway's construction.

**Norris Garrett Bell**, Engineer-in-Chief and Commissioner of Commonwealth Railways, was responsible for completing the railway after Deane's resignation in 1914, and was the first Commissioner of Commonwealth Railways from 1917 to 1929.

#### 4. FEDERATION AND AN EAST - WEST TRANS-CONTINENTAL RAILWAY

The construction of the Trans-Australian Railway was unique in the history of Australian railway construction. Unlike the railway networks built for the colonial (later state) governments, which were each built by a government to satisfy its own internal transportation demands, the Trans-Australian Railway was a product of political and strategic pressures to provide interstate railway communication between Western Australia and the eastern states. The strategic advantages of a transcontinental railway were obvious to military planners, but the political issues were more involved and took longer to resolve.

During the decade before 1900, as the Federation movement gained momentum in the eastern colonies, there was far less support for Federation in Western Australia, and the majority of ministers in the Western Australian Government was consistently anti-federationist. By contrast, Sir John Forrest, who was the Western Australian Premier throughout the 1890s, as early as 1888 had expressed conditional support for Federation. The condition which he advocated most strongly was similar to the one which British Columbia had won for its entry into the Canadian federation – a transcontinental railway link.<sup>1</sup>

Western Australian delegates participated in the framing of the first draft Federal Constitution in 1891 and attended the later Conventions. Forrest was also active in the crucial Premiers' meeting, in January 1899, at which agreement was reached on the final draft Constitution. Between June and September 1899, the five eastern colonies passed referenda accepting the draft Constitution. However, in Western Australia the Legislative Council refused to permit a referendum.

A Joint Select Committee of the two Western Australian Houses proposed four amendments to the Constitution Bill in September 1899, one of which was intended to facilitate the construction of a transcontinental railway through South Australian territory.<sup>2</sup>

At the end of December 1899, Forrest sailed for the eastern colonies in an attempt to have the four amendments accepted by the other colonies. With their delegates already on the way to London to attend the passage of the Commonwealth Constitution Bill, the eastern premiers were in no mood for last minute amendments. Forrest did, however, obtain an agreement from the South Australian Premier, Sir Frederick Holder, that South Australia would not block the construction of a transcontinental railway built by the Commonwealth through South Australia.

On 9 July 1900, the Commonwealth Constitution Bill received the Royal Assent in London, and on 31 July, the citizens of Western Australia, in a referendum, voted by a large majority to accept the Constitution.<sup>3</sup> Contrary to popular belief, the Constitution contained no provision for the future construction of a transcontinental railway. Although the Commonwealth's founding fathers and leading politicians, Deacon, Barton, Forrest, Kingston, and Reid, had all spoken in favour of the railway as an important symbol of Federation, its political genesis was to prove far more prolonged than any might have expected.



## 5. COLONIAL EAST – WEST COMMUNICATIONS

From the earliest days of the Swan River settlement Western Australia was the most isolated of the Australian colonies. It was not until 1841 that Edward John Eyre became the first European to reach Western Australia overland from South Australia, and it was another thirty years before John Forrest's party made the first overland journey from the west. During the 1870s, hardy pioneers, following in Forrest's footsteps, established small pastoral settlements along the Western Australian coast as far as Eucla, while pastoralists from the east were reaching westwards.

In December 1877, the Western Australian telegraph which had been built along the coast from Albany linked up with the South Australian telegraph from Port Adelaide at Eucla on the interstate boundary. The East-West Telegraph linked Western Australia for the first time with the other Australian colonies, and, through the Overland Telegraph from Adelaide to Darwin, with the rest of the world. The first steps towards a railway link between the two western-most colonies began in 1878, when the South Australian Government commenced laying a narrow gauge line northwards from Port Augusta, reaching Quorn in December 1879. From Quorn this line was extended southwards, to link up with the broad gauge line at Terowie in May 1882, providing a rail link between Adelaide and Port Augusta.<sup>4</sup> In Western Australia, the first east-west line in the Perth metropolitan area, from Fremantle to Guildford, was opened in 1881, and was extended through the hills to the Avon valley towns of York, Northam and Beverley in 1884-86.<sup>5</sup>

The 1880s was the decade of extravagant land grant railway schemes. Two ambitious schemes were proposed for east-west railways, one from Eucla to Beverley (1884) and another from Port Augusta via Eucla to either Northam or York (1887). Both schemes were abandoned after the proponents made unacceptable demands, or failed to convince the Parliaments of their capacities to carry out the undertakings.<sup>6</sup> Another private railway, from Port Augusta to Phillips Pond, in north-western South Australia (near present-day Woomera), was proposed in 1884, but after a Government surveyor reported less than enthusiastically on the route, the Government lost interest in the scheme.<sup>7</sup>

The South Australian Government was really more interested in a north-south transcontinental railway than in an east-west one. During the 1880s, it pressed ahead with the construction of a railway which was intended to be the first stage of a north-south line. In 1884 a narrow gauge line from Quorn to Marree was completed, and by 1891, this had been extended to Oodnadatta, 1 110 rail kilometres from Adelaide. In the Northern Territory, which at the time was administered by South Australia, the first northern link in the north-south line, the railway from Darwin to Pine Creek, was completed in 1889.<sup>8</sup>

### **Gold finds in Western Australia**

The discovery of gold in the Kimberleys, in 1885, set up a chain reaction of exploration and gold discovery in Western Australia. Although gold was found in the Yilgarn in 1887, most early exploration activity was in the north west and the Murchison until 1891, when prospectors returned to the unknown eastern districts beyond Southern Cross. The discovery of gold at Coolgardie, in 1892, started the largest rush of the 1890s, which was soon followed by numerous others,

including the one to Kalgoorlie in 1893. The granting of self government, in 189, had given the WA Government access to the London loan market. Using the security of its gold discoveries, the Government embarked on large scale borrowing to finance a major public works programme to service the goldfields, and at the same time, to provide infrastructure for the long term development of the colony's agriculture, pastoralism and timber industry. A railway network centred on Perth and Fremantle harbour was one of the main elements of this works programme. By 1894, the eastern railway had been extended to Southern Cross, and in 1896, it reached Coolgardie, and in 1897, Kalgoorlie. By 1901 a third of the state's population lived in the eastern goldfields. The majority were 't'other-siders' from the eastern colonies who constituted the state's largest group in favour of Federation and of the construction of a transcontinental railway. They also strongly opposed control of the goldfields by the Perth-based oligarchy.

In 1898, South Australia and Western Australia had a final opportunity to cooperate in advancing the cause of an east-west railway. The South Australian Premier, Charles Kingston, had written to Forrest supporting construction of the railway. As a practical move to further its progress, in 189,7 Kingston dispatched a survey team under a railway engineer, A G Pendleton, to investigate a route from Port Augusta to the border via Tarcoola, and also to evaluate the pastoral and mineral potential of the area. In the same year, H Y L Brown, the SA Government Geologist, made a geological and ground-water survey of the Ooldea region. In 1898, while Forrest and Kingston were in the UK for a Colonial Conference, the Acting SA Premier, Frederick Holder, armed with Pendleton and Brown's reports, wrote to WA's Acting Premier, Edward Wittenoom, suggesting that similar surveys be carried out in Western Australia. Wittenoom, without consulting Forrest, replied that Western Australia was not ready to make such a survey. Forrest wrote to Kingston on their return to Australia, pledging mutual cooperation on the route survey, but it was already too late, as the mood had changed in Adelaide. With Federation now considered inevitable, a transcontinental railway was looked upon as a Commonwealth responsibility.<sup>9</sup>

One of Forrest's last acts as Premier, in early 190, was to instruct his Engineer-in-Chief, C.Y. O'Connor, to carry out a feasibility study for the Western Australian section of a transcontinental railway. O'Connor's report to the Commonwealth Parliament, which was made on 1 May 1901, gave thirteen reasons why the railway should be built and estimated its construction cost to be £2460 per kilometre.<sup>10</sup> It was no coincidence that the main topic of Forrest's maiden speech in the House of Representatives, on 22 May 1901, was the urgent need for a Kalgoorlie to Port Augusta railway.<sup>11</sup>

O'Connor also commissioned his Inspector of Surveys, John Muir, to carry out a 'flying survey' of the railway route from Kalgoorlie to the border. Muir with a party of nine men and sixteen camels left Kanowna, near Kalgoorlie, on 16 May, and followed a diagonal route from Kanowna to Eucla. On the return trip, they followed approximately the eventual alignment of the railway, arriving back in Bulong on 19 August 1901, having covered over 1 770 kilometres. Although no major physical obstacles had been encountered, the party's major problem had been in maintaining adequate water supplies.<sup>12</sup> Later in the same year, the South Australian Engineer-in-Chief, A.B. Moncrieff, inspected for himself some of the more remote sections of the eastern end of the possible route, and reported very similar findings as those of Muir. Prime Minister Barton convened a conference of state railway engineers-in-chief in March 1903, at which all the accumulated data and reports on the proposed railway were reviewed.<sup>13</sup> However, there were still a number of political obstacles to overcome.

## 6. TOWARDS A DECISION TO BUILD THE RAILWAY

In September 1903, the Western Australian Parliament passed the Trans-Australian Railway Enabling Bill, and Premier Walter James suggested to Premier J.G. Jenkins of South Australia that Jenkins' Government do likewise. To James' surprise, Jenkins did not consider himself bound by Holder's promise of 1900. He declined to introduce an enabling bill until the Commonwealth had passed its own legislation and until the route and rail gauge of the line had been agreed.<sup>14</sup>

In April 1904, Forrest introduced the Trans-Australian Railway Survey Bill to the House of Representatives. The Bill was eventually passed later in the year (although under a different government), but passage of the Bill through the Senate proved more difficult, as Senators still voted according to state allegiances. Only the Western Australians and some of the Senators from NSW voted for the Bill. The Senate again rejected the Bill in 1905 and 1906 and threatened to continue to do so 'until South Australia gave permission' for the line to be built. The impasse was solved by Prime Minister Alfred Deakin in 1907, during his negotiations for the transfer of the Northern Territory from South Australia to the Commonwealth. The SA Premier, Tom Price, wanted a promise of a north-south railway included in the agreement, and Deakin wanted assurances that the east-west line could proceed. So the Northern Territory Acceptance Bill included permission for the Commonwealth to build both lines through South Australian territory. Consequently, in an historic division at the end of 1907, Senators abandoned for the first time voting by state to pass the Survey Bill.<sup>15</sup>

The Engineers-in-Chief, under the chairmanship of Henry Deane, the retired Engineer-in-Chief of NSW Government Railways, met again in February 1908 to organise the survey. The WA Government was to survey the route from Kalgoorlie to the state border, and the SA Government from Port Augusta to the border. Two alternative routes were proposed for the latter, via Tarcoola and via the Gawler Ranges. However, the engineers reported that the £20 000 voted for the survey was insufficient to investigate both routes. The Tarcoola route was chosen, as it was the one preferred by the South Australian Government.<sup>16</sup>

### Route surveys

Richard Anketell, an engineering surveyor who had also been a member of Muir's 1901 flying survey, led the Western Australian party, which consisted of three other surveyors, ten camelmen and assistants and 91 camels. They left Kanowna on 1 July 1908. Anketell went ahead with an assistant setting the alignment by compass and checking it by stellar observations. He marked the route by means of a heavy 'snigging chain' drawn by one of his camels, a simple, effective, method of his own devising. The chaining, pegging and leveling party followed. The pack camels left 270 litre caches of water every eleven kilometres, and at each of these, the camel wagon party established a new camp every night. By the end of September, the party reached the border, where it built a cairn and then turned south for the small telegraph station town of Eucla, where the members had a well earned rest. Most of the camels and camelmen then returned along the coast to Norseman. A small party, including Anketell and another surveyor, Geoffrey Drake-Brockman, returned along the pegged line to look for additional water supplies, and to locate and size culverts, while the remainder of the party sailed for Albany on 8 October 1908.<sup>17</sup> Drake-Brockman later

wrote a succinct comment on Anketell's organizing ability. 'We built no heroes but we left no bones'.<sup>18</sup>

The South Australian survey party, under J.T. Furner, left Port Augusta in June 1908, and passed through the last pastoral run at Wilgena (410 kilometres). By August they were through the Wynbring and Ooldea sand hills and toiled through the heat of the summer to finally reach the border cairn, over 960 kilometres from Port Augusta, on 19 March 1909.<sup>19</sup> In the meantime, in February 1909, Henry Deane had been appointed 'consulting railway engineer' to the Department of Home Affairs, the Commonwealth department responsible for the railway. Deane inspected part of the western pegged line from Kalgoorlie in April 1909 and the eastern line from Ooldea to Port Augusta by July.<sup>20</sup> He then began work on his recommendations and estimates for what was, at that time, the largest railway project ever undertaken in Australia.

In September 1911, the Minister for Home Affairs in the Fisher Labor Government, King O'Malley, introduced the Kalgoorlie to Port Augusta Railway Bill, and at the same time released Deane's report on the railway.<sup>21</sup> Deane estimated that the line would cost £4.045 million if laid unballasted with 70 lb rail (both recommendations which he later altered in favour of an 80 lb ballasted line). On the contentious issue of construction by contract versus construction by day labour, Deane advocated the use of day labour, based on his long experience of its use in the construction of railways in NSW.

The Kalgoorlie to Port Augusta Railway Act 1911 passed through both Houses and received the Governor General's consent on 12 December 1911.<sup>22</sup> On January 1 1912, Henry Deane began work as Engineer-in-Chief of the new railway. He was faced with a huge task. He had to build a complex railway organisation from scratch and at the same time organise the largest construction project ever undertaken in Australia. Moreover, it was to be built through some of the most inhospitable and remote parts of the continent, most of which were without any surface water supplies. In addition he had to put up with incessant political meddling from both sides of Parliament.

## 7. BUILDING THE RAILWAY

On 14 September 1912, the Governor General, Lord Denman, turned the first sod at the South Australian end of the railway, in a ceremony at Port Augusta attended by 250 invited guests and the residents of Port Augusta. A similar ceremony was performed by the Prime Minister, Andrew Fisher, at the Kalgoorlie end of the line on 12 February 1913.<sup>23</sup>

### **Tenders for materials**

The quantities of material required to construct the railway were huge; 2 300 000 sleepers, 136 000 tons of rail and 10 000 tons of fishplates, plus all the other permanent way material such as dog spikes, sleeper plates, and turn-outs. Over 1030 working drawings for construction work and rolling stock standards had to be prepared. Tenders had to be called for the whole range of railway equipment and rolling stock, including locomotives, wagons, cranes, accommodation coaches and water tankers, and for construction materials such as cement, water pipes, and telegraph wires. Workshops, locomotive sheds and store sheds had to be built at Port Augusta and Kalgoorlie, for both 'temporary' use during construction and for later operational use.

International tenders for almost all of the project's rail requirements were called in February 1912, but the prices submitted were so excessive that O'Malley rejected the bids. After the reissue of tenders for much reduced tonnages, American and British mills obtained orders for 33 600 tons and G. & C. Hoskins, Australia's only steelmaker, received one for 9 500 tons. More significantly, in January 1913, BHP which, until then, had been solely a silver-lead miner and ore processor, commenced work on the construction of its Newcastle steelworks. In January 1915, the first shipment of iron ore, from Iron Knob in South Australia, arrived at the works, and on 24 April 1915, the first of 45 000 tons of rail produced by BHP for the Trans-Australian Railway was manufactured. The railway's requirements and the wartime disruption in steel supplies had launched BHP as a steelmaker.<sup>24</sup>

All aspects of the tendering process were subject to intense political scrutiny, and none more so than that for the supply of sleepers. Western Australia was the only state which still had large areas of forest containing timbers suitable for sleepers. The state's timber industry was dominated by Millars' Timber & Trading Co., which had been formed in 1902, by an amalgamation of the eight largest millers in the state. In 1912, it produced 50 per cent of the state's timber and 75 per cent of its timber exports. The Scaddan State Labor Government was anxious to break the company's control over prices and to develop unworked karri forests (as the two major karri areas previously logged at Denmark and Karridale had been worked out).<sup>25</sup>

Although Deane considered jarrah to be the best sleeper timber, he was prepared to accept karri sleepers treated by powellising, an American chemical treatment process championed by O'Malley. When Millars declined to tender for the sleeper contract, which closed in April 1912, Scaddan retaliated by pressing ahead with the formation of the State Saw Mills, and the construction of three mills at Manjimup and Pemberton. After negotiations between Scaddan and O'Malley, a contract for the supply of 1 400 000 powellised karri sleepers and 100 000 jarrah sleepers was finalised in August 1912.<sup>26</sup>

The winter of 1913 was an exceptionally wet one in the south west, so the original date for the start of sleeper deliveries was extended from 1 June 1913 to 13 November 1913. However, because of further delays, the new Cook non-Labor Federal Government cancelled the contract in February 1914. This could have had a disastrous affect on the railway construction programme, had not a further agreement been signed with the State Saw Mills to supply 500 000 powellised karri sleepers. Deliveries began in July 1914.

### **Water supplies**

One of the major problems to be overcome during the construction of the railway, and also during its operation, was the supply of sufficient quantities of water of suitable quality. At Kalgoorlie, water was available from the Goldfields Water Supply Scheme by pipeline from Mundaring. However, the ambitious proposal, originally made by John Muir, the WA Inspector of Surveys, and later also by Deane, to pump Scheme water to the highest point on the Trans-Australian Railway, 159 kilometres from Kalgoorlie, and then to gravitate it eastwards to service another 800 kilometres of railway, had to be abandoned because of the huge cost of piping the water, despite the proposed use of wood stave pipes instead of steel ones.<sup>27</sup>

Along the first 270 kilometres east of Kalgoorlie, where the line runs through open woodland, a number of dams were built to collect surface runoff. Most of these were lined with bitumen, and a number were covered, but none was very reliable. East of 270 kilometres, across the limestone-saltbush country and the Nullarbor Plain itself, and through the Ooldea sandhills to around 1 120 kilometres from Kalgoorlie, there is negligible run-off, and water had to be obtained from underground bores. In this section, twenty-seven bores yielded a total of approximately 1 300 kilolitres per day, but the quality obtained was far from satisfactory for use in locomotive boilers. The depths to supplies generally varied from 60 to 180 metres, but some had to be driven through the underlying granite, and one struck water at 448 metres.<sup>28</sup>

For about four years, two early model McDonald kerosene tractors were used to move water boring machinery ahead of the eastern railhead, and for operating the equipment, the first time such equipment had been used in Australian railway construction. Both were fitted with Bottrill Pedrail wheels, which gave them an all terrain capability, especially useful in the salt lake and sandhill country.<sup>29</sup> Boring machinery working ahead of the western railhead was moved by camel wagons. At the eastern end of the line, Port Augusta was serviced by a reliable water supply at Depot Springs, and two other good underground supplies were obtained in South Australia at Wirraminna (253 kilometres from PA) and at Kingoonya (338 kilometres from PA). Water trains carted potable water from these sources to the inland depots.

When construction commenced, Deane purchased six retired suburban locomotives from NSWGR (designated D Class) to haul construction and supply trains (three for each railhead). Because of their age and the poor quality boiler water used, they suffered numerous breakdowns, which slowed construction in 1913-14. The situation was relieved, in mid-1914, with the delivery of twelve G Class locomotives, which were overdue from the makers (Clyde Engineering, Sydney, and Baldwin Loco. Works, Philadelphia). The G Class locos also had frequent boiler failures, and as the lengths to the railheads increased, those in service were worked to their limits, running averages of over 8 000 kilometres per month in mid 1916. To reduce locomotive down time, intermediate loco depots were established, usually between 160 and 240 kilometres apart, at which emergency

repairs could be made. Eventually, to provide better quality boiler water, a water-softening plant was built at Port Augusta and water condensers at Cook and Ooldea.<sup>30</sup>

### **Earthworks**

Horse-drawn tumbling scoops were used extensively for earthmoving on the railway. Where more extensive cuttings were required, notably in the sandhills between Barton and Ooldea, excavation was done manually into side-tipping trucks on tramways.<sup>31</sup> Several Marion steam shovels were also used in major cuttings. A total of 3.8 million cubic metres of earthworks had to be completed for the railway. A fifth of this was moved by the eastern gangs in one thirty-two kilometre length of the Barton sandhills, during 1916-17. Because of the fine nature of the sand and the frequency of blinding dust storms, working conditions in the sandhills were some of the most trying on the project.<sup>32</sup>

The summer of 1913-14 was a critical time in the administration of the railway construction. A drawn out strike was crippling the western works, and work on both fronts was suffering from a chronic shortage of locomotives. The new Cook non-Labor Government was attempting to reverse some of the Fisher Government's policies on railway management and sleeper contracts. Deane found himself under fire from both sides of Parliament, especially over a 'catch up' earthworks contract, which had been let to a leading contractor Henry Teesdale Smith. By February 1913, Deane had had enough and resigned.

One of the first priorities of the new Engineer-in-Chief, Norris Garrett Bell, was to provide better living conditions and food for workers at the railheads and other workplaces, such as major earthworks, ballast pits and loco depots.<sup>33</sup> The administration took over the management of many of the boarding houses and also set up new ones, all of which provided cheap, clean, accommodation. It also established 'ranch houses' which supplied good meals at city prices. By the end of construction, the 'ranch houses' had served over a million meals. A special train (the forerunner of the 'Tea and Sugar' train) was outfitted to supply workers at intermediate locations with provisions and services. In 1916, the year in which employment in the field peaked at 3 395, the turnover of the railway's six stores and three bakeries reached £60 000.<sup>34</sup>

### **Tracklaying**

One of Deane's last recommendations to the Commonwealth was that the line should be ballasted. To effect this, Bell established four ballast quarries and crushing plants along the line, but it was another twenty years before ballasting of the complete line from Kalgoorlie to Port Augusta was completed. Bell also moved to improve communications along the line by speeding up the construction of the lineside telegraph, and in May 1915, radio sets designed by the Commonwealth's first engineer for radio-telegraphy, J.G. Balsillie, and installed in trucks, began operating at the two railheads.<sup>35</sup>

Almost all the mainline track was laid using the two tracklaying machines which had been obtained from Roberts Brothers of Chicago, on O' Malley's recommendation in 1912.<sup>36</sup> Australian platelaying records were achieved by the two teams which stood for nearly fifty years. These were:

Greatest length in any one day: 4.023 km  
in any one week: 23.537 km.  
in any four weeks: 75.035 km.

Greatest length in any six months: 402.938 km.  
In any one year: 712.213 km.<sup>37</sup>

Crossing the Nullarbor in summer, the midday temperature often exceeded 45° C in the shade, and on one occasion 55° C was recorded. Work was rescheduled for early morning and late afternoon, as all steelwork and tools became too hot to touch. The tracklayers had to find what shelter they could during the midday break. <sup>38</sup> By 24 October 1914, the western railhead was at Zanthus, 201 kilometres from Kalgoorlie, and on 20 March 1915, it had reached Naretha at the very edge of the Nullarbor.

The historic meeting of the two railheads occurred on Wednesday, 17 October 1917, near Ooldea, 691 km from Port Augusta and 1001 km from Kalgoorlie.<sup>39</sup> It was fitting that Captain F.W. Saunders, who had been the Construction Superintendent in the east from the very beginning in 1912, had the honour of reporting the event to Bell. His telegram was eloquent in its brevity:

Rails linked today, Wednesday, one forty-five pm, South Australian time, at six-twenty-one miles fifty-eight chains fifty point five links. Saunders.<sup>40</sup>

The final cost of the 1682 km long railway was £6 667 360, compared with Dean's figure of approximately £4million.<sup>41</sup> Considering the large rise in the cost of materials and labour that occurred during the war, and the additional works involved, such as ballasting and heavier rail, to have completed the works for the final cost was a remarkable achievement. There was another significant cost in terms of human lives. There was an average accident rate on the project of 180 a year, which considering the numbers employed, was probably no higher than on other contemporary railway works. However, 20 men died from work-related incidents. In addition, 15 died from typhoid in 1912 and 1915 on the eastern works alone, and several are known to have died on the western section, so the figure is probably nearer 25.<sup>42</sup>



## 7. PLANNERS AND BUILDERS

### EMINENT PERSONS ASSOCIATED WITH THE PLANNING AND BUILDING OF THE RAILWAY

#### **Sir John Forrest, first Baron of Bunbury**

John Forrest (1847-1918) was one of the first politicians to publicly promote an east-west trans-continental railway when, in 1888, he suggested that its construction should be one of the conditions required by Western Australia for joining an Australian Federation. For the next 25 years he seldom missed an appropriate opportunity to advocate construction of the railway.

Forrest was born in Bunbury, Western Australia, and trained as a surveyor, joining the staff of the Surveyor General's Office in 1865. In 1869, he led an expedition in search of the explorer Leichhardt, into what later became the Western Australian north-eastern goldfields. In 1870, a party led by him became the first to cross from Western Australia to South Australia by following along the coast of the Bight. In 1874, he led a party from Geraldton eastwards to meet the Overland Telegraph from Adelaide to Darwin.

In 1883 Forrest was appointed Surveyor-General and Commissioner for Crown Lands, and was for seven years an ex-officio member of the Executive and Legislative Councils. When responsible government was granted in 1890, he became the colony's first Premier and Treasurer, positions which he held until Federation. Forrest's Government took advantage of the mining boom to embark on a programme of public works which attempted the difficult task of balancing the interests of the metropolitan, agricultural, pastoral, mining and forestry regions.

At Federation, Forrest was elected to the House of Representatives as Member for Swan, a seat which he held until his death in 1918. He served as Treasurer in five ministries, and was also Minister for Defence and Minister for Home Affairs. In this last capacity he introduced the unsuccessful Trans-Australian Railway Survey Bill in 1904. He supported the Bill when it was again introduced unsuccessfully in 1905 and 1906, and on its eventual successful passage in 1908. He later supported the Kalgoorlie to Port Augusta Railway Bill which was introduced by the Labor Government in 1911. He was in opposition during most of the railway's construction, but was Treasurer in the Hughes Nationalist Government, when the railway was completed in 1917, and rode on the first official train from Port Augusta to Kalgoorlie. He died in the following year while on the way to England to be installed as the first Australian-born baronet.

#### **Henry Deane, Engineer-in-Chief, Department of Home Affairs 1912-1914**

From 1903, when he chaired the conference of railway Engineers-in-Chief at which the functional requirements of a trans-continental railway were discussed, Henry Deane was the engineer most closely involved in the planning and mobilisation for the construction of the railway, and in the organisation of what was to become Commonwealth Railways. He was appointed consulting railway engineer to the Commonwealth Department of Home Affairs in February 1909, and for the next two years was engaged in preparing recommendations and cost estimates for the construction and operation of the railway. After the passage of the Kalgoorlie to Port Augusta Railway Act in

1911, Deane was appointed Engineer-in-Chief for the new railway, the construction of which was to be the largest engineering project undertaken to that date in Australia.

Deane was born in England in 184, and after studying engineering at King's College, London, he served his indentures with the railway engineer, Sir John Fowler. In 1869, he joined Waring Bros on the construction of a Hungarian railway, and then worked in a shipyard on the Danube. In 1877, he was engaged in building sugar refineries in the Philippines, and in 1880 arrived in Sydney. He joined the NSW Government Railways as a surveyor, and within a year was made a district engineer for new construction. In 1886, he was appointed Inspecting Engineer for all new works on the system. When John Whitton, Engineer-in-Chief for Railway Construction, retired in 1891, Deane succeeded him. During the next sixteen years, Deane was responsible for the construction of some 500 miles of new lines, and also for electrifying the Sydney tramways, including the construction of the Ultimo power station. On retirement from the Railways on reaching the age of sixty, Deane established a consulting engineering practice. In the next two years he was responsible for the construction of the private Wolgan Valley Railway, which ran through very rugged sections of the Blue Mountains to provide access to the oil shale center of Newnes.

As the first Engineer-in-Chief of the TAR, Deane had the misfortune to be caught between the opposing forces in several political struggles, which were not of his own making. He was also subjected to a good deal of unwarranted interference from one of the 'responsible Ministers', King O'Malley. The first of the political struggles was between Labor Party advocates of railway construction by day labour and the railway contractors and anti-Labor politicians who advocated construction by contract. The second was the struggle of the WA Labor Government of Jack Scaddan to reduce the power of the dominant Millars timber milling group in WA by establishing a government-owned State Saw Mills. Both the contractors and millers, which had close connections, saw the actions of the two Labor governments as posing a direct threat to their operations. Matters came to a climax in 1913, when the Cook non-Labor Government gained control of the Lower House in Canberra and attempted to reverse some of the Fisher Government's policies, despite Labor still controlling the Senate. Deane's subsequent resignation, in February 1914, was probably inevitable. However, he remained commendably silent about the actions of his political masters, and was only roused to public comment when, in a 1916 report, his successor, N.G. Bell, found it convenient to blame Deane for a number of Bell's difficulties at the time.

### **Norris Garrett Bell, Engineer-in-Chief and Commissioner of Commonwealth Railways**

The position of Engineer-in-Chief of The Department of Home Affairs was advertised only a week after Deane's resignation, and by 25 March 1914, the Chief Engineer of Queensland Railways, W. G. Bell, had been chosen from the nineteen applicants. Bell was born in Dundee, Scotland, in 1860, was educated at Edinburgh University, and received his practical engineering training on the Scottish railways. He emigrated in 1886, and joined Queensland Railways, working initially as resident engineer on the two remote northern lines, from Cooktown to Laura, and from Normanton to Croydon. He spent 28 years with Queensland Railways, before taking up the post of Engineer-in-Chief of the Trans-Australian Railway in Melbourne on 1 April 1914. The following year he was also given the title Acting Commissioner, and after the successful completion of the Trans-Australian Railway in 1917, was appointed Commissioner of Commonwealth Railways, a position he retained until his retirement in 1929.

Although appointed by the Cook Government, Bell preferred construction by day labour rather than by contract. He claimed to have maintained the cost of constructing the Queensland government railways at less than £1800 a mile by using day labour rather than by employing contractors. On his appointment the Government's plans to construct the remainder of the railway by contract were put on hold, and were then abandoned when the Fisher Labor Government was returned in the September 1914 election. In the meantime, Bell had enjoyed some of the luck which Deane had lacked. The three big problems of early 1914, the deadlock over sleeper deliveries in WA, a drawn out strike in the west and a critical shortage of locomotives, had all been resolved. Bell was also allowed much more latitude in spending and planning than Deane had received.

With the immediate crises of 1914 behind him, Bell took the opportunity to institute a number of administrative reforms in the servicing and living conditions at the railhead, and in inter-branch cooperation. These were to be critical in the eventual completion of another two years of track laying which had to be carried out in increasingly remote locations.

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<sup>1</sup> Frank Crowley, *Big John Forrest 1847-1918*, Nedlands, WA, 2000, p.84, 96-98

<sup>2</sup> Crowley, pp.236-38, 251-56.

<sup>3</sup> Crowley, pp. 270-72, 289-91.

<sup>4</sup> D. Burke, *Road through the Wilderness*, Kensington, NSW, 1991, p.31.

<sup>5</sup> F.K. Crowley, *Australia's Western Third: A History of Western Australia*, Melbourne, 1970, pp.74-75.

<sup>6</sup> 'Report of the Select Committee of the Legislative Council appointed to consider...a land grant railway from Beverley to Eucla', WA Parliament *Votes & Proceedings (V&P)*, 1884, Paper A20; 'Report of the

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Select Committee of the Legislative Council appointed to consider...land grant railway from York or Northam to Eucla', WA Parliament V&P, 1887, Paper A16.

<sup>7</sup> Burke, pp.36-38

<sup>8</sup> Burke, p.33.

<sup>9</sup> Burke, pp.50-51.

<sup>10</sup> 'Australian Transcontinental Railway (Kalgoorlie to Port Augusta via Tarcoola)', Report by C.Y. O'Connor, Commonwealth Parliament, *Votes & Proceedings of the House of Representatives*, 1901-02, Paper A5.

<sup>11</sup> Crowley (2000), p.312.

<sup>12</sup> 'Transcontinental Railway: Report on Preliminary Examination of country between Kalgoorlie and Eucla by John Muir, Inspector of Engineering Surveys, 31 October 1901', WA Government, V&P, 1901, II, Paper 42; Judith Anketell, *Walker in the Wilderness: The Life of R.J. Anketell*, Carlisle, WA, 1998, pp.44-64.

<sup>13</sup> Burke, pp.54-56.

<sup>14</sup> Burke, pp. 57-58.

<sup>15</sup> Crowley (2000), pp.378-84; Burke, pp.58-66.

<sup>16</sup> Burke, p.67.

<sup>17</sup> Anketell, pp.91-115; Geoffrey Drake-Brockman, *The Turning Wheel*, Perth, 1960, pp.43-52.

<sup>18</sup> Drake-Brockman, p.50.

<sup>19</sup> Burke, p.68-69.

<sup>20</sup> Burke, p.69.

<sup>21</sup> Burke, p.74; 'Kalgoorlie to Port Augusta Railway: Report of the Consulting Railway Engineer (H. Deane), Melbourne, 20 September 1911', Commonwealth Parliamentary Papers, 1911, II, Paper 26.

<sup>22</sup> Burke, p.79.

<sup>23</sup> Burke, pp.100-05.

<sup>24</sup> Burke, pp.86-88.

<sup>25</sup> J.R. Robertson, 'A History of the Timber Industry of Western Australia', University of Western Australia BA Honours thesis, 1956, pp.51-53, 93-94.

<sup>26</sup> Burke, p.96

<sup>27</sup> Burke, p.186.

<sup>28</sup> P. Adam Smith, *The Desert Railway*, Adelaide, 1974, pp.46-55; R.J. Fitch, *Making Tracks: 46 Years in Australian Railways*, Kenthurst, NSW, 1989, p.92; Burke, p.216.

<sup>29</sup> G.R. Quick, *Australian Tractors: Indigenous Tractors and Self Propelled Machines in Rural Australia*, Richmond, NSW, 1990, pp.61-64; Adam Smith, pp.50-51. A.H. McDonald was Australia's first tractor manufacturer. The models used were McDonald EC. The Bottrill Pedrail, an Australian invention, was the most successful tracklaying device for converting vehicles for all-terrain use before the crawler tractor became available after WW1.

<sup>30</sup> Burke, pp.200, 234-35; Port Dock Railway Museum, *Locomotives and Railcars of the Commonwealth Railways*, Wellard, SA, 1996, pp.26-29.

<sup>31</sup> Adam Smith, pp.26-27, 70-72

<sup>32</sup> Burke, pp.211-13.

<sup>33</sup> Burke, p.143.

<sup>34</sup> Burke, pp.153, 162-63, 202-03. Six stores and three bakeries were established along the line.

<sup>35</sup> Burke, pp.180-81.

<sup>36</sup> Burke, p.125-26.

<sup>37</sup> R. Stewien, 'Draft Nomination of the Trans-Australian Railway..as a National Engineering Landmark', Torrens Park, SA, 1999, p.5.

<sup>38</sup> Burke, p.180, 217.

<sup>39</sup> Burke, pp.244-45; Adam Smith, pp.94-96.

<sup>40</sup> Burke, p.247.

<sup>41</sup> Burke, p.248.

<sup>42</sup> Burke, p.213.